Australian and New Zealand College of Veterinary Scientists

Membership Examination

June 2021

Medicine and Management of Laboratory Animals

Paper 1

Perusal time: **Fifteen (15)** minutes

Time allowed: **Two (2)** hours after perusal

Answer **ALL <u>FOUR (4)</u>** questions

Answer **<u>FOUR (4)</u>** questions, each worth 30 marks total 120 marks

Paper 1: Medicine and Management of Laboratory Animals

Answer all four (4) questions

1. With reference to mice in a research environment:

   a) Discuss the anatomical and physiological features that influence the effects of anaesthetic drugs on the animal. *(5 marks)*

   b) Describe the procedure for anaesthetising neonatal mice, using hypothermia. Include the precautions needed to avoid tissue damage as well as those necessary to minimise the risk of maternal cannibalism when the neonates are returned to their mothers. *(5 marks)*

   c) For adult mice, discuss the advantages and disadvantages of inhalation versus injectable anaesthesia. *(10 marks)*

   d) When using inhalant anaesthesia in mice:

      i. List the workplace health and safety (WHS) risks for staff. *(5 marks)*

      ii. Discuss ways to mitigate WHS risks using substitution, engineering and/or administrative management controls. *(5 marks)*

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2. Answer **both** parts of this question:

a) For each of the following species, list **three (3)** acceptable chemical and/or physical methods used for euthanasia, **excluding those listed in part 2 b)** of this question:

i. rats *(3 marks)*

ii. rabbits *(3 marks)*

iii. sheep. *(3 marks)*

b) For each species and method of euthanasia listed below, briefly discuss the advantages and disadvantages of the nominated method. Comment on animal welfare impact, training requirements and any potential interference with research results:

i. rats - CO_2 asphyxiation *(7 marks)*

ii. rabbits - barbiturate overdose *(7 marks)*

iii. sheep - use of captive bolt combined with a secondary method of euthanasia. *(7 marks)*

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3. Answer **both** parts of this question:

a) Explain dietary modifications that are required to meet nutritional requirements in the following circumstances:

i. sheep housed indoors in raised pens (no bedding) *(3 marks)*

ii. rabbits housed in cages *(3 marks)*

iii. guinea pigs housed under specific pathogen-free conditions *(3 marks)*

iv. zebrafish larvae *(3 marks)*

v. mice housed in germ-free isolators. *(3 marks)*

b) Discuss the aetiopathogenesis of:

i. lactic acidosis (grain overload) in sheep moved directly from grass feed in paddocks to pellet feed in indoor pens *(5 marks)*

ii. mucoid enteropathy in rabbits moved from penned to caged housing *(5 marks)*

iii. vitamin C deficiency in guinea pigs. *(5 marks)*

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4. Answer **both** parts of this question.

a) List **two (2)** alternate methods of sanitisation or sterilisation of the following items in specific pathogen-free rodent barriers:

i. bedding *(2 marks)*

ii. cage cards/ paper *(2 marks)*

iii. computers and other electronic devices. *(2 marks)*

b) For the sanitisation or sterilisation method listed for each item below:

- comment on the effectiveness in preventing the introduction of pathogens and the operational factors that may impact on effectiveness,
- propose quality control tests to assess the effectiveness of the method, and
- comment on the potential for workplace health and safety (WHS) injuries and how the risk(s) can be mitigated.

i. caging - wash/dry via high-temperature tunnel washer *(8 marks)*

ii. feed - gamma irradiation *(8 marks)*

iii. water - sterilisation using autoclave. *(8 marks)*

End of paper

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Paper 2

Perusal time: **Fifteen (15)** minutes

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Answer **ALL FOUR (4)** questions

Answer **FOUR (4)** questions, each worth 30 marks.....total 120 marks

Paper 2: Medicine and Management of Laboratory Animals

Answer all four (4) questions

1. A researcher has been working with a mouse model of systemic lupus erythematosus (SLE) for the last three years. By crossing male New Zealand black (NZB) mice with female New Zealand white (NZW) mice, female offspring NZB/W F1 mice spontaneously develop autoimmunity and a lupus-like phenotype, with severe kidney failure expected at 10 to 12 months of age. When severe kidney failure was seen earlier (in mice four to five months of age), the facility veterinarian was asked to investigate the potential reasons for this phenotypic change.

   a) Answer **all** parts of this sub-question:

      i. List the factors that may impact on phenotypic expression in mice. *(4 marks)*

      ii. List at least **two (2)** pathogens, including an emerging pathogen, that can cause kidney lesions in mice. (*2 marks)*

      iii. Assuming the aetiology is an infectious agent, list appropriate diagnostic samples and diagnostic modalities required to obtain a diagnosis. *(6 marks)*

      iv. Outline a plan to eradicate such a pathogen from the animal facility and describe biosecurity control measures that should be implemented to obtain a colony of mice that are free from this pathogen. *(8 marks)*

   b) Identify the state/territory you are working in. Discuss the relevant state/territory legislation, government permits and institutional approvals that need to be considered if the researcher wants to source an alternative, genetically modified, mouse model from overseas. *(10 marks)*

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2. A researcher wants the animal facility to breed rabbits and produce batches of neonates. The animal facility has a room with floor pens currently housing stock rabbits, but is not currently set up for breeding.

a) Describe how existing floor pens can be modified for breeding by answering the following questions:

i. Describe the design of nesting boxes, their inclusion in, or connection to, the pen and the number of nesting boxes per doe. *(5 marks)*

ii. Discuss how the design of a breeding pen and management of group housing can minimise fighting. *(5 marks)*

iii. Draw a floor pen plan to illustrate the points in 2 a) i and ii (above). Include the proposed location of nesting boxes, watering points and feeders, and recommend suitable environmental enrichment items. *(5 marks)*

b) Answer **all** parts of this sub-question:

i. Briefly discuss the oestrous cycle, optimal male:female ratios, length of gestation and the process of pregnancy diagnosis in rabbits. *(5 marks)*

ii. List **two (2)** different methods of mating pen-housed does, and briefly discuss the advantages and disadvantages of each method. *(5 marks)*

iii. List the factors that contribute to neonatal losses in rabbits and briefly discuss how they can be minimised. *(5 marks)*

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3. In an experimental facility, nude mice involved in a long-term xenograft study are developing a wasting disease. Over the last three months, 60% of the mice housed for longer than two months have reached their weight-loss end point before the xenograft experiment can be completed. After reviewing the available data and observing the xenograft implantation surgery, it was found that most affected mice were implanted subcutaneously with tumours that had been previously passaged in mice and the aseptic technique during surgery was substandard.

a) Answer **all** parts of this question:

i. In addition to the agent identified in 3b) (below), list at least **five (5)** pathogens known to cause weight loss in nude mice. *(5 marks)*

ii. Discuss the potential for disease transmission from tumours passaged previously in mice and explain how this can be prevented. *(5 marks)*

iii. Briefly discuss: *(5 marks)*

- the pathology arising following the use of poor aseptic technique in immunodeficient mice,
- the pathogens most likely to be transmitted due to poor aseptic technique,
- the measures that can be taken to improve aseptic technique in a research setting.

b) Affected mice test positive for mouse hepatitis virus (MHV).

Discuss:

i. the epidemiology of MHV and identify at least **three (3)** ways the mice in this colony may have become infected *(5 marks)*

ii. the clinical signs and gross pathology expected at post mortem *(5 marks)*

iii. the changes in facility management that should be made following disease eradication, in order to prevent a recurrence. *(5 marks)*

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4. A rat breeding facility was recently equipped with individually ventilated cages (IVCs). You are asked to update the health monitoring program to include the use of exhaust air duct (EAD) sampling. In-line exhaust duct filters are available from the manufacturer.

a) Answer **all** parts of this sub-question:

i. Discuss the relative effectiveness of health screening in IVCs using: *(10 marks)*

- dirty bedding sentinels
- sample collection from colony rats
- environmental screening (such as an exhaust air duct filter or cage exhaust filter).

ii. Discuss the advantages of using a combination of EAD samples with other sample collection methods, such as dirty bedding sentinels or colony rat screening. Include consideration of the following factors in your answer: *(5 marks)*

- cost
- the value of additional information that may be obtained.

b) EAD health monitoring produces a positive result for Kilham rat virus (KRV) in two racks in a breeding room.

Answer **all** parts of this sub-question:

i. Describe the appropriate process for follow-up testing. *(5 marks)*

ii. List possible sources of environmental contamination that may produce false-positive results for KRV on EAD samples, and explain how the risk of environmental contamination be minimised. *(5 marks)*

iii. Discuss the purpose of post-rederivation health monitoring and propose a health monitoring plan. *(5 marks)*

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